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On the solution of free surface flows with the SPH and related methods

SPH (Smoothed Particle Hydrodynamics) is a Lagrangian mesh free method used since the end of the seventies in the simulation of astrophysics problems. Monaghan proposed extensions to gas dynamics and free surface problems. Original SPH regain more popularity in the nineties, especially for impact and large deformation mechanical problems. In the first part of the talk, a state of the art on SPH will be given. A relationship between SPH and the finite element-finite volume method will be emphasized with application to the solution of the Shallow-water equations. This formulation gives the possibility to introduce well-known finite elements or finite volume stabilization techniques for high speed flows. The problem of dam break in various two-dimensional configurations is used as the benchmark test. The result obtained depends on the concerned problem. For the cases of standard and circular dams, the results are quiet encouraging. The capture of shocks and the shape of the waves were successfully revealed. The success of the SPH in the solution of free surface flows depends on the optimisation of its parameters, a smart choice of particles number, type of the kernel and the smoothing of irregularities in the geometry. In case of irregular boundaries, some difficulties are encountered for imposing proper boundary conditions, and require additional investigations.